IEREK PRESS
Academic Research Community
CrossMark
http://www.ierek.com/press
ISSN (Print: 2537-0154, online: 2537-0162)
ARChive
International Journal on: **The Academic Research Community Publication**
DOI: 10.21625/archive.v2i1.238

Development of Urban Transportation System Based on Bus Rapid Transit

(Study Case : Kendari City, South East Sulawesi Province, Indonesia)

Adris Ade Putra[1]

[1]*Dr.,ST.MT ,. Transportation Engineering, Department of Civil Engineering*
University of Haluoleo Kendari, Indonesia

Muammar Makmur[2], **Muh Arsyad**[3]

[2]*ST.M,Eng ,. Structural Engineering, Department of Civil Engineering*
University of Haluoleo, Kendari, Indonesia
[3]*ST.M,Si,. Urban Planning Engineering, Department of Architecture Engineering*
University of Haluoleo, Kendari, Indonesia

Keywords

Keywords: Transportation, Services, Bus Rapid Transit, Routes, Bus Stops

Abstract

Urban transport systems in Indonesia have been influenced by kinds of traffic problems such as congestion, high accident rates and traffic violations and uncomfortable, safe, and orderly levels of public transport services. To develop urban transportation systems, a policy implementation is needed in public transportation such as special lanes for Bus Rapid Transit (BRT) as one of the alternative solutions to give better services for the public transport user.

The purpose of this study is to count the demand of bus rapid transit, determine number of corriors and halte for the BRT as well as know the types of BRT which should be operated in Kendari City in accordance with the needs of public transport users. The method used in this study is the quantitative method by collecting primary and secondary data which includes OD Matrix of destination of the population travel, Number of Passengers up and down on each route, Load factor in each route, Travel time and Road Inventory Data. Other data include Road length, Road width, Road type, width of trotoar, width of median, and Road Pavement type.

The results of this research is that the number of demand for public transportation in Kendari City are 28 buses with 8 units in the first corridor, 6 units in the second corridor, 8 units in the third corridor, and 6 units in the fourth corridor. Indeed, the total number of corridors needed to operated of BRT in Kendari requires 174 shelters. The potential population in Kendari City is categorized on the modest development and the existing conditions of the road, which is not too large for the BRT line planned. Therefore, the possibility of increasing the number of passengers then the type of bus which may be used as a fleet of BRT at the beginning of the operation is large floor buses total capacity of 79 people consisting of 49 seated passengers and 30 passengers standing

1. Introduction

Urban transport systems in Indonesia have been influenced by kinds of traffic problems such as congestion, rising of trip demands, lack of traffic discipline, dominance of private vehicles, inconsistency to develop land-use system, use of roads that are not fit to their function, the public transport service is not good, low accessibility, long trip time, discomfort and lack of safety in public transport, and the cost is high. Urban areas in Kendari City have promlematic transportation systems like the other urban areas in Indonesia. The quick changes of land-use system have not been anticipated through the arrangement of good transport system; the operation of public transport services is still focused on certain roads causing some roads to be congested.

Public transportation is very limited and does not have a fixed schedule or fixed bus tops causing the accumulation of vehicles at one point in the road during certain hours. Besides that, the dominance of small capacity public transport (pete-pete) causes many problems, especially its impact on traffic smoothness such as service levels are low, uncomfortable, and low accessibility and lack of good public transport services (pete-pete). This is indicated by the increased congestion and reduced levels of service roads (V / C ratio) of 0.36 to 0.78 or traffic conditions that could potentially delay to congestion (Putra, 2006).

Urban transport system requires a planning policy implementation in the urban public transport system. The development of mass transportation such as Bus Rapid Transit (BRT) is very important to be prepared by the city government as one of the alternative solutions to problems of transportion to reduce the dependence of urban communities on private vehicles or small capacity of public transportation. The development of mass public transportion is an effort to give service priority to users of public transport so that public transportation would be more appealing. By reducing the use of private transport, congestion and traffic on highways will be reduced.

Small Cappacity public transportation in Kendari City (pete-pete) is regarded as one of the causes of the problems of transportation systems. Development of Bus Rapid Transit (BRT) can improve the quality of public transportation services. this is in accordance with the mandate of Law Number 22 of 2009 about Traffic and Transportation in article 158 paragraph (1) stating that the government guarantees the availability of mass transit-based ways to fullfil the needs of people by providing common motor vehicles in urban areas. Given the problems and the current condition of public transport systems as mentioned above, it is necessary to develop urban transport systems based on Bus Rapid Transit (BRT) in Kendari City.

2. Literature Review

2.1. Urban Transportation System

Urban transportation systems have an important role in enhancing the economic development of society toward the development of an area (Murray, 2001). The transportation system is a system to perform a movement from one place to another place. We need a transport system in the implementation of planning techniques to develop an optimal strategy in the provision of facilities and infrastructure of urban transportation systems (MorIok, 1991). Urban transportation systems have consequences for the social dimension such as welfare and justice for the people (Ahmed et al., 2008; Kenyon et al., 2002). Good function of transportation system properly is a factor that pushed for the development of community activities. Transportation provides movement access to the center of trade, education and housing. Inappropriate Strategy and program to develop the transportation system can damage the land use, environment and the capacity of the public space. Ineffective network services will not be able to fullfil the expectations of users of public transportation (World Bank, 1996). The transportation system in urban areas is related to the concentration of people and socio-economic activities of the population (Loo and Chow, 2006).

Urban transportation systems of developing countries emphasized on the development of a sustainable transportation system. UNFPA (1999), 95% of formation of human activities in the period 2000 to 2030 will occur in urban areas in developing countries. IEA (2008), the growth of in urban areas forms a pattern of global energy use and impact on the urban transportatin system. Urban areas need infrastructure of transportation for the movement of the population. Hall and Pfeiffer (2000), the cities of developing countries will face a lot of problems of transportation system that impact traffic congestion and accidents (death and injury). Urban transportation systems have various problems such as the low level of service, discomfort and unsafety (Pucher et al., 2005).

Urban transportation systems have challenges in making policies based on the potential of the region by prioritize to the economic growth, environmental preservation and prosperity of the present generation and the generations in the future (Zietsman and Rilett, 2001). The main priority is revamping the urban transportation system emphasized on the issue of the effectiveness of public transportation services as it will have an impact on the urban environment and the opportunity for the community to improve its quality of life (Holden and Norland, 2005). Planning of urban transportation systems requires the integration of environmental and the social economics of the population and it also needs the right strategy to improve the transportation system, particularly the aspects of security, comfort and arranging the land use (Schileer et al., 2010). Yao (2007) in his research explained that the

demand for public transport system based on a potential area by using characteristic variables of urban areas as well as land-use system.

2.2. Mass Transportation Development

Mass transportation systems can provide quality service and the main factor of mass transportation concept includes high quality infrastructure, efficient operations, effective and transparent institutional systems, advanced technology, and excellent marketing and customer service. Mass transportation systems such as BRT have been developed in several cities such as Bogota (Colombia) and Curitiba (Brazil). The BRT system that is also applied in developing countries includes Guayaquil (Ecuador), Jakarta (Indonesia), Pereira (Colombia), Brisbane (Australia), Ottawa (Canada) and Rouen (France). Mass transportation systems in about 40 cities on six continents have implemented BRT system, one of the cities that successfully implemented the BRT system is TransMileno. The success of TransMileno influenced by the government's capacity in the planning and design the transportation modes use very good technology, good corporate management, well-planned investments in infrastructure, and well-defined ticketing systems (Wright and Fjellstrom, 2003).

The development of urban mass transportation needs policies that consider many aspects such as planning, financing, ownership of vehicles and so on. One important aspect needed to develop an interesting mass transportation system is the analysis of the loss/profit of mass transportation, whether the system will improve or worsen the urban transportation system. The development of a mass transportation system is seen as an effective way to improve the quality of public transportation services in urban areas. Market competition will require service providers to provide products with an efficient transportation system oriented towards the public (Echeverry et al., 2005). The development of mass transportation leads to higher investments and greater revenues into the market. The income can replace government subsidies, but the investments in mass transportation is difficult to make a profit (Mees and paul, 2005). Different demands of various groups participated influence policy-making, the development of mass transportation in urban areas have forced by particular group, so that the development of mass transportation is not efficient (Bianco and Martha, 1999). The central government is too focused on paying attention to cost reduction rather than improve services in the public transportaion service system (White, 1997). The ability to improve public transportation services is a challenge for all stakeholders involved in the policy making of the transportation systems. The government becomes an effective tool to organize mass transportation. Some transportation systems have emerged such as the bus system Transmileneo in Bogota that is controlled by the public sector yet operated by the private sector. Even though some problems with these systems have been observed, the public/private form has been used in many developing countries (Echeverry et al., 2005).

3. Methods

3.1 Data Collection and Compilation

1) Secondary Data

Secondary data is data obtained from several government agencies with regard to the data needed in transportation planning. Government agencies include:

- Department of Transportation in Kendari
- Regional Planning Agency
- Police
- General Research Department
- Statistics Agency

2) Primary Data

Primary data is data obtained directly with the aim to determine the existing conditions to formulate proposals the point of bus stop. Primary data needed include:

- Data of the number up and down the passenger
- Data of household interviews (Home Interview)
- Data of willingness to change from private transportation to public transportation
- Data of Road Inventory

3.2 Data Collection Methods

To get the data as mentioned previously, the data collection was carried out in various ways including

- Secondary data: get the contact to the related institutions to request the required data;
- Primary data is conducted using surveys such us Dynamic Survey, Passengers Interview Survey, Household Interview Survey, Road Inventory Survey

3.3 Data Collection

To clarify the primary data collection techniques, they will be explained below:

1) Dynamic Survey

Dynamic Survey is a survey in public transportation vehicles to determine the number of passengers up and down on the route which is divided into several segments.

The methods used in this survey include:

- Record number of passengers up and down
- Record time of trip in each segment

A dynamic survey was carried out in two days on duty (not on holidays). There were a number of observations carried out on at least six (6) round trips during the morning rush, six (6) round trips during hours that are not considered busy time and 6 (six) round tripd in the afternoon during rush hours for each route observed.

2) Household Interview Survey

household interview survey is a survey to interview the residents of Kendari City with a predetermined number of samples. The sample is determined based on the amount of each different zone in accordance with the existing population in the zone.

3) Roads Inventory Survey

This survey was conducted by recording the dimensions of the road. The collected data includes:

- Length of the road
- Width of the road
- Road type
- Width of sidewalk
- Width of median
- Pavement of the road

The survey was carried out across the street in Kendari City, this data supports Bus Rapid Transit in Kendari. With this data, we can determine which path is suitable for the Bus Rapid Transit and the width of the sidewalk data is also necessary to plan the construction of the bus stop.

3.4 Compilation and Analysis of Data

Compilation of data is data collection of primary and secondary data obtained from the surveys that have been conducted. Compilation and analysis of data are used to facilitate the process of analysis to be carried out in the Bus Rapid Transit plan.

data compilation includes:

1. OD Matrix in Kendari City
2. OD Matrix in Kendari City to community who use public transport;
3. Number up and down passengers on each route;
4. Load dynamic factor in each route;
5. Trip time;
6. Road inventory data;

Information from the data analysis includes:

- Route of Bus Rapid Transit;
- Type of BRT Bus;
- Number of bus stops on route/Corridor of Bus Rapid Transit;

4. Results and Discussion

4.1. Physical Condition of Kendari City

1) Geographic Conditions

Kendari city has a land area of 295.89 km^2 or 0.70 percent of the land area of Southeast Sulawesi province. The total area of each district is very diverse. District of Abeli is the most extensive district region (16.77%), followed by the district of Baruga (16.76%), district of Poasia (14.71%), district of Puuwatu (14.43%), district of Mandonga (7.89%), district of Kambu (7.82%), district of West Kendari (7,77%), district of Kendari (6.61%), district of Wua-Wua (4.17%), and the district of Kadia (3.08%)

Kendari is the capital city of Southeast Sulawesi province astronomically located in the south of the equator among 3˚ 54` 11`` 30``- 4˚ 3` south latitude and stretches from west to east between 39` 23`- 122˚ 122˚ east longitude.

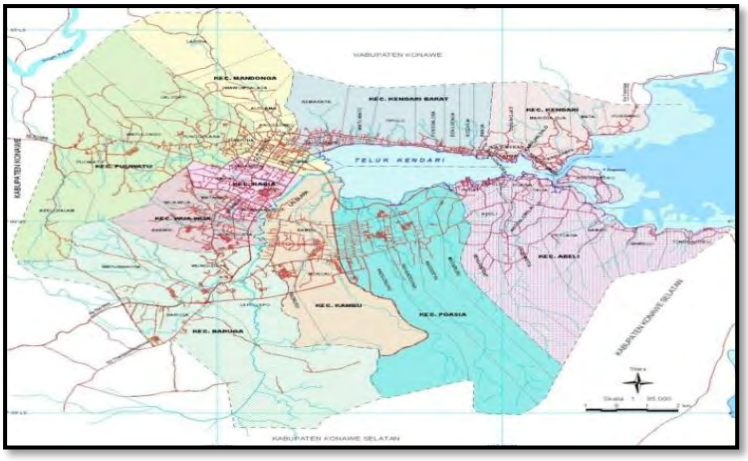

Figure 1. Map of Adiministration of Kendari City

2) Population Condition

In 2016, the population of the city of Kendari ± 295.732 people spread in 10 districts and 64 sub-districts. The overall population each year has increased 1.99% (according to the Civil Registry). Size of Kendari is 295.89 km^2 and the population density is 999.466 inhabitants per-km2. The population density each year has increased together with population growth.

3) Transportation Conditions

a. Road Network Condition

Good road conditions will facilitate the mobility of people and facilitate transportation to move goods to other economic and social activities. Conversely, when road conditions are less good, people will have difficulty in relationships of economic activity and other activities. In 2016, for the length of streets in Kendari city, there are 38 percent in good condition, 30 percent moderate condition, 25 percent in a damaged condition, and 7 percent in severely damaged condition

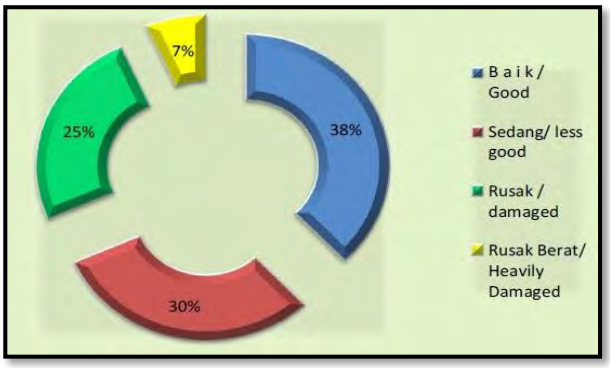

Figure 2. State Road Surface Condition by Surface in Kendari

b. Public Transportation

The public transportation service in Kendari City consists of City Transportation has 9 already existing routes and 3 routes that are in the planning phase but are approved by the mayor of Kendari but are not functioning optimally yet. The type of vehicle used is a type of Public Passenger Car which has a capacity of 12 people.

c. Public Transportation Infrastructure

Good public transport infrastructure supports the performance of public transportation in a city. The right public transportation facilities will increase public transportation services such as right location of bus stops and strategic location of terminals. Other facilities such as departure information board are very important for passengers in using public transportation.

4.2. Data Collection Results

1) Determination of Traffic Zone

The determination of traffic zones in Kendari city is based on land use maps in Kendari City. The area has been divided into internal zones and external zones. Kendari city is divided into 33 internal zones, 3 special zones and 5 external zones. The following map of Kendari City Road Network and Zone Map is determined based on the terms zoning:

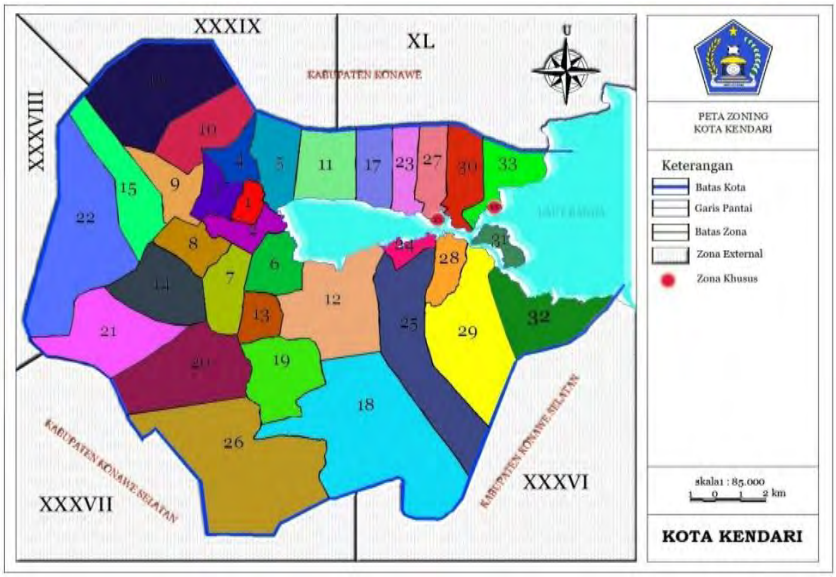

Figure 3. Distribution Zone Map

2) Data Collection

a. Land Use Survey

Land use is a condition of land use in the study area. In the study area there are a variety of land uses such as tourist areas, educational areas, residential areas, office areas, plantations, agriculture, and others. For residential areas in Kendari, the largest population is living in the Kendari Barat District. In the book of Kendari, 2016 recorded that the largest land user in Kendari which amounted to 23.52% or 6959 hectares of 29859 hectares of land in Kendari used as the building, then the second largest used as a garden which is equal to 16.86% or 4990 hectares. Land Use Conditions in Kendari city influece the transportation system in the city, because land-use influences the accessibility or convenience of the public to reach places that provide their needs. The following is a map of Kendari Land use:

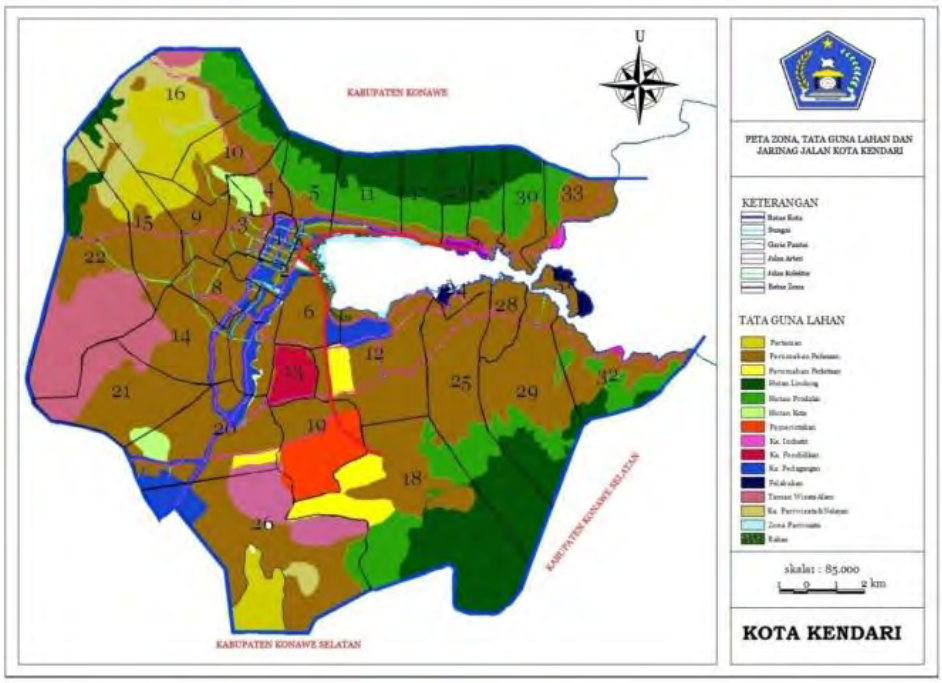

Figure 4. Map of Land Use Kendari

It can be seen from the land use maps above that Kendari city is mostly covered in scattered housing. For areas that are farther to the center of town, the distance between one house to another house is relatively far such as the sub-district Bungokotoko, Abeli, Mata and others.

b. Household Interview Survey (Home Interview)

Household interview surveys were conducted in each and every zone with a predetermined number of samples. Surveyors collect the information based on a list of questions that had been prepared about the state of the family and its occupants trips in a certain period. All the residents of the house were directly questioned.

The data collected should include:

1. Households data
2. Data on household members
3. Data of the regular trips by occupants

Household data and household members are data that associated with the address, number of occupants, the number of vehicles owned, family income, age, gender, location of work, the location of schools / education.

Data of trips that was collected is data of trip for each member of the family, schedule of trip, trip destination, and mode of transportation used.

4.3 Result of Data Analysis

1) Generation and Atraction of Trip (Base on Result of Home Interview)

The generation of the trip is the number of trips of each zone in the area of research, which is the journey by each member of the family in any internal zone.

Table 1. Table Matrix Origin - Destination Person/Day (Population)

OD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Oi
1	2832	3706	3147	1818	3322	804	1818	3392	1503	979	2028	909	385	1678	559	839	839	245	804	1364	315	455	1538	944	280	105	1364	140	70	455	245	70	455	40210
2	3776	2308	1503	140	804	594	944	1818	245	769	839	979	734	1469	350	105	280	280	210	140	280	280	175	140	70	140	280	210	175	420	105	210	140	21538
3	2972	1434	1189	70	769	455	490	2797	490	140	420	839	944	490	70	70	210	455	769	210	210	175	280	70	70	455	734	35	70	455	105	35	245	18392
4	1608	140	105	1014	524	175	455	420	245	455	455	210	210	70	175	35	35	70	105	35	35	70	35	70	385	105	105	35	35	594	105	70	105	8462
5	3112	874	734	455	1643	350	524	769	944	350	1469	455	769	350	175	105	315	420	594	559	140	70	245	245	70	35	1853	105	70	699	35	280	490	20000
6	490	420	175	280	245	315	1888	1364	245	70	140	1678	1224	559	70	140	70	245	629	420	105	105	105	559	140	105	70	140	70	70	70	70	105	12622
7	1783	804	664	245	420	2028	5944	1608	140	245	280	594	2552	210	210	105	35	385	1434	1224	455	105	35	350	245	1084	175	105	140	35	70	105	70	25070
8	3357	2063	2727	315	769	1364	2028	2972	909	350	524	1608	3007	2203	105	140	105	350	1399	1993	769	175	280	664	455	559	664	140	105	70	70	35	35	32762
9	715	109	218	93	404	109	62	404	809	62	47	62	233	31	93	47	62	156	16	124	31	342	47	31	62	78	62	31	16	47	47	31	16	5101
10	171	140	47	93	62	16	31	16	16	264	16	16	16	16	16	16	16	16	16	31	16	31	47	16	16	16	16	16	16	16	31	16	16	1322
11	2552	804	385	420	1608	140	245	280	70	35	2517	210	245	455	140	140	664	105	105	70	140	70	140	245	70	105	35	140	35	140	70	105	350	13217
12	1049	979	734	210	420	1783	839	1503	140	105	210	734	1084	385	140	105	280	804	1154	594	210	245	559	664	490	140	210	210	70	210	140	175	175	17517
13	327	327	358	156	249	560	1120	1089	280	93	124	700	747	404	327	47	78	218	886	404	420	47	140	389	124	233	62	218	47	47	62	62	109	10809
14	1573	1469	524	210	245	524	455	2308	70	105	734	490	769	2168	385	245	140	490	315	1084	140	385	210	140	420	105	70	70	70	140	105	70	105	16993
15	295	171	31	109	78	78	62	78	109	31	62	62	295	187	840	47	31	109	62	249	31	622	31	109	109	124	16	47	31	31	31	47	47	4479
16	373	31	47	62	62	62	47	62	47	124	62	47	47	140	16	840	16	16	16	31	16	16	31	62	31	31	16	31	16	47	31	16	16	2675
17	594	175	175	140	210	70	70	175	140	70	524	315	175	175	70	35	140	105	70	140	70	70	420	70	70	105	140	105	35	280	35	70	210	5699
18	420	210	350	105	385	210	315	420	385	175	105	909	490	490	245	35	35	1329	699	385	420	35	35	1154	804	245	70	70	35	105	280	105	35	11643
19	451	78	311	31	187	171	575	607	31	31	47	498	964	140	78	16	31	249	249	513	93	47	31	171	109	109	31	47	31	93	62	16	16	6221
20	1399	140	210	70	594	420	1259	1538	350	70	140	559	874	1294	664	35	105	420	1399	1364	944	70	594	140	70	2203	140	105	70	105	35	70	35	17867
21	280	124	78	16	47	47	187	233	47	62	31	62	404	156	62	16	31	171	93	389	886	124	31	31	124	404	16	16	16	16	16	16	31	4370
22	607	560	389	124	156	187	156	62	311	78	124	140	202	140	591	124	78	124	140	140	156	1493	47	31	31	109	109	62	31	31	47	16	31	7061
23	1049	350	140	70	315	105	105	350	105	105	105	559	350	140	175	70	524	140	105	490	70	70	1189	210	70	70	385	105	70	35	35	70	210	8566
24	467	78	62	62	62	280	124	264	31	47	78	358	358	31	140	47	16	560	124	47	16	16	16	1306	264	47	47	467	124	31	218	404	16	6407
25	249	62	16	47	47	93	62	47	47	16	47	62	156	218	93	16	31	358	93	31	93	31	47	404	513	47	62	311	62	62	109	233	31	4121
26	455	210	315	70	140	210	839	420	210	70	140	140	594	280	280	35	105	280	420	2308	944	105	70	35	35	1783	35	70	35	35	70	70	35	11608
27	1434	245	839	140	1364	105	175	629	105	105	140	175	140	105	105	70	280	70	105	175	35	35	420	35	70	70	1713	210	699	140	105	105	1434	12203
28	31	140	16	16	78	47	16	62	31	47	62	124	233	16	16	31	47	47	31	78	16	16	31	435	311	31	62	1213	544	31	264	109	16	4432
29	109	31	31	16	47	62	62	31	16	31	31	62	78	31	31	16	93	62	78	47	47	31	31	249	93	31	295	575	700	16	47	451	47	3701
30	490	385	455	490	490	70	70	35	105	105	140	175	140	175	70	140	420	140	280	105	35	35	35	70	70	70	70	70	35	1119	70	70	350	6818
31	50	50	30	30	10	50	30	30	30	10	10	20	50	30	10	20	20	70	60	20	10	20	20	140	90	10	30	120	20	20	260	50	40	1530
32	140	78	31	31	124	31	62	31	31	16	62	62	62	47	31	31	31	47	16	31	31	16	31	295	171	31	93	93	482	31	93	1664	31	4308
33	156	62	124	47	295	31	31	16	16	31	233	78	140	78	47	16	202	16	16	16	31	16	124	62	31	16	638	16	62	295	47	31	2131	5614
Od	35838	19123	16306	7327	16721	11609	21563	26000	8660	5407	12187	14268	19012	14608	6632	3964	5607	8829	12505	15107	7238	5621	7441	9696	6401	9110	10132	5453	4151	6031	3252	5169	7637	382398

Source: Results of Analysis

Total of the trip resulting from the matrix of origin-destination in the form of the trip amount of 382 398 population trip person/day

Table 1**.** from Table Matrix Origin-Destination we can get information about the distribution of the trip in each zone and the largest trip distribution was obtained from zone 2 to zone 1 with the number of trips being 3,776 persons per day because the first zone is CBD (Central Business District) area with the characteristics of trade, services, and government so giving rise to the journey towards the zone 1 or commonly called the attraction of the trip.

From the table above it can be concluded that:

a) The number of the largest generation of trip contained in zone 1 was 40.210 trips person per day, because the zone 1 is the area of trade, services, government and residential areas.
b) Smallest generation of the trip is in zone 9 of 5.101 trip person per day which is a residential area that is far from the center of the city.
c) The number of the largest attraction trip contained in zone 1 of 35.838 trips person per day. This is because of the zone 1 as Center Central Business District (CBD).
d) The smallest attraction of the trip is in the zone 31 of 3.252 trips person per day because the area is a residential area that is predominantly fishermen that is located relatively far from the city center. Besides that, land use of zone 31 is mostly empty land.

From the analysis of generation and attraction of trip in each zone, the obtained map of Kendari Desire Line in the image below. The desire line shows the black bars indicating the number of trips taken, the thick line shows that the higher rate of trip. Base on Kendari desire line can be seen trip from zone 2 and zone 1 has a high rate of trip. Meaning of trip generated by the zone 2 and zone 1 has a high level of generation of trip to another zone.

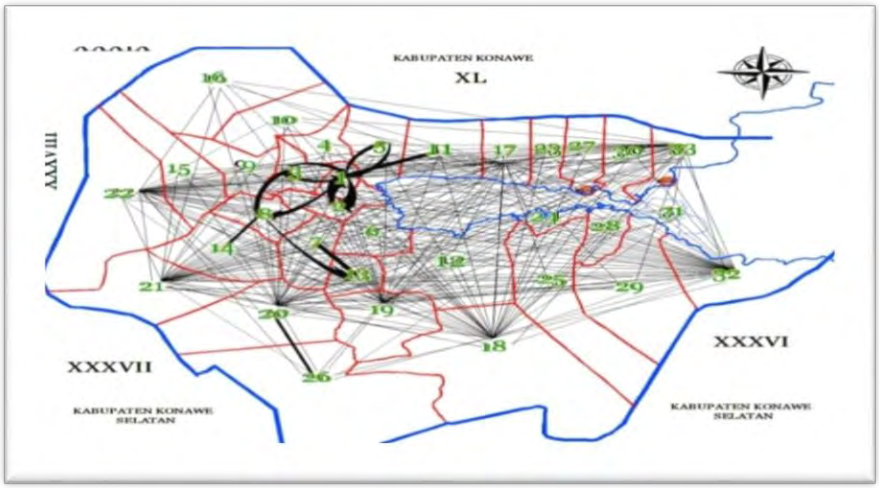

Figure 5. Map of Desire Line

4.4 Corridor of BRT In City Kendari

1) Corridor I

City Central Market - Jl. Moh.Hatta - Jl. P.Diponegoro - Jl.Sultan Hasanuddin - Jl. Mayjend Sutoyo - Jl. Mayjend S. Parman - Jl. Dr. Sam Ratulangi - Jl. Drs. Hj. Abdulah Silondae - Jl. Jend. Ahmad Yani - Jl. Mayjend D. Pandjaitan - Jl. Christina Martha - Jl. Capt. Piere Tendean - Jl. Robert Wolter Monginsidi - Airport Haluoleo: The total length of the path taken is ± 30251 m. The figure below shows the BRT Corridor I (Purple color line)

2) Corridor II

City Central Market - Jl. Pembangunan - Jl. Dr. Sutomo - Jl. Ir. Hj. Alala - Jl. Edi Sabara - Jl. Brigjend Soegiarto - Jl. Malaka - Jl. Bunggasi - Jl. Haji Banawula - Terminal Lapulu. the path taken is ± 16706.81 m. Figure below shows BRT Corridor II (Green color line)

3) Corridor III

Port Bungkutoko - Jl. Haji Banawula - Police Abeli - Jl. Imam Bonjol - Faculty ITK - Police Sultra - Jl. Haluoleo - Jl. Boulevard - Jl. Capt. P. Tendean - Jl. Robert W. Monginsidi - Airport Haluoleo. The length of the path taken is ± 34 627 m. The figure below shows BRT Corridor III (Blue color Line)

4) Corridor IV

Terminal Puuwatu - Jl. Moh. Yamin - Jl. Chairil Anwar - Jl. Mayjend Donal Panjaitan - Jl. Christina Martha - Jl. Capt. Piere Tendean - Jl. Robert Wolter Monginsidi - Airport Haluoleo. The length of the path taken is ± 25 139 m. The figure below shows BRT Corridor IV (Black color line)

5) Corridor Intersection

Picture map below shows the intersection of the Corridor I, Corridor II, Corridor III and Corridor IV of BRT Kendari. The following location of four corridors intersection:

1. Intersection of Corridor I (purple line) and Corridor IV (black bars) is at the office of State Electricity Company on Jl. Mayjend D. Pandjaitan;
2. Intersection of Corridor I (purple line), Corridor III (blue line) and Corridor IV (black bars) is at the junction round of Baruga;
3. Intersection of Corridor II (green line) and Corridor III (blue line) is at the traditional market of Lapulu.

Picture below is a picture of the intersection of the four corridors.

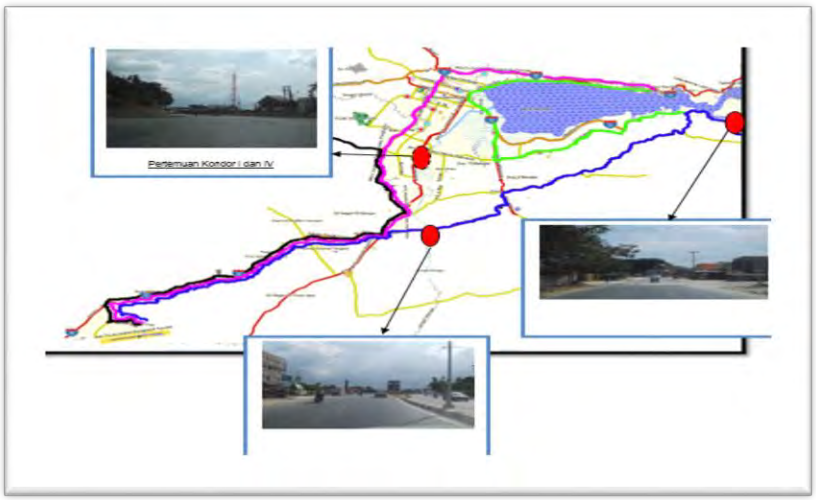

Figure 6. Map of the intersection of Corridor I, II, III and IV

4.5 Location of Bus Stop

Bus stops are public transportation stops building for lowering and/or raising the passengers.

1) Corridor I

From the results of the study with regard landmarks around the road to be traversed BRT in Kendari Corridor I ± 30.251 m, number of bus stop location as many as 39 (thirty-nine) are placed on the right and left of the road for the total amount to 78 (seven twenty-eight) bus stop on CorridorI.

2) Corridor II

Corridor II ± 16706.81 m, number of bus stop location as many as 20 (twenty) are placed on the right side and left of the road for the total amount to 40 (forty) bus stop on Corridor II.

3) Corridor III

Corridor III ± 34 627 m, number of bus stop location as many as 15 (fifteen) were placed on the right and left of the road for the total amount to 30 (thirty) bus stop on Corridor III.

4) Corridor IV

Corridor IV ± 25 139 m, number of bus stop location 13 (thirteen) were placed on the right and left of the road for the total amounted to 26 (twenty-six) bus stop on Corridor IV.

5. Conclusions

Based on the results of the discussion, it can be concluded as follows:

1) The number of public transportation requires in Kendari City is as much as 28 bus. 8 units Bus for corridor I, 6 units Bus for corridor II, 8 units Bus for corridor III and 6 units bus for corridor IV.
2) This bus operation is divided into four corridors,:
   a. City Central Market - Jl. Moh.Hatta - Jl. P.Diponegoro - Jl.Sultan Hasanuddin - Jl. Mayjend Sutoyo - Jl. Mayjend S. Parman - Jl. Dr. Sam Ratulangi - Jl. Drs. Hj. Abdulah Silondae - Jl. Jend. Ahmad Yani - Jl. Mayjend D. Pandjaitan - Jl. Christina Martha - Jl. Capt. Piere Tendean - Jl. Robert Wolter Monginsidi - Airport Haluoleo: The total length is ± 30251 m
   b. City Central Market - Jl. Pembangunan - Jl. Dr. Sutomo - Jl. Ir. Hj. Alala - Jl. Edi Sabara - Jl. Brigjend Soegiarto - Jl. Malaka - Jl. Bunggasi - Jl. Haji Banawula – Terminal Lapulu. Total length is ± 16706.81 m.
   c. Port Bungkutoko - Jl. Haji Banawula - Police Abeli - Jl. Imam Bonjol - Faculty ITK - Police Sultra - Jl. Haluoleo - Jl. Boulevard - Jl. Capt. P. Tendean - Jl. Robert W. Monginsidi - Airport Haluoleo. Total length is ± 34 627 m.
   d. Terminal Puuwatu - Jl. Moh. Yamin - Jl. Chairil Anwar - Jl. Mayjend Donal Panjaitan - Jl. Christina Martha - Jl. Capt. Piere Tendean - Jl. Robert Wolter Monginsidi - Airport Haluoleo.
3) The potential population in Kendari City is categorized on the modest development and the existing conditions of the road is not too large for the BRT line planed. So, the possibility of increasing the number of passengers then the type of bus which may be used as a fleet of BRT at the beginning of the operation is large floor buses total capacity of 79 people consisting of 49 seated passengers and 30 passengers standing.
4) Number of the bus stop for Bus Rapid Transit in Kendari: Corridor I= 78 units, Corridor II = 40 units, Corridor III = 30 units, Corridor IV = 26 units.

References

1. Ahmed, Q.I., Huapu, L., and Shi, Y, 2008, Urban transportation and equity: A case study of Beijing and Karachi, *Transportation Research Part A:* Policy and Practice, Vol. 42, pp. 125–139.
2. Bianco.,and Martha J., 1999, Technological Innovation and the Rise and Fall of Urban Mass Transit, *Journal of Urban History*. 25 (3):348-378.
3. Echeverry., Juan., A. M, Ibez., Andri, S. M., dan Luis C. H., 2005, The Economics of Trans Milenio, a Mass Transit System for Bogota, *Economia*. 5:151-196.
4. Hall, P.A., and Pfeiffer, U., 2000, Urban Future 21: a Global Agenda for Twenty-First Century Cities, London: *Spon*, p.21.
5. Holden, E., dan Norland, I.T., 2005, Three challenges for the compact city as a sustainable urban form: Household consumption of energy and transport in eight residential areas in the Greater Oslo Region*". Urban Studies*, Vol. 42, No. 12, pp. 2145–2166.
6. IEA (International Energy Agency)., 2008, World energy outlook 2008, Paris: *IEA*
7. Kenyon, S., Lyons, G., and Rafferty, J., 2002, Transport and social exclusion: investigating the possibility of promoting inclusion through virtual mobility, *Journal of Transportation Geography,* Vol. 10, No. 3, pp. 207–219.
8. Loo, B.P.Y., dan Chow, S.Y., 2006, Sustainable Urban Transportation: Concepts, Policies, and Methodologies", *Journal of Urban Planning and Development*, Vol. 132, No. 2, pp. 76–79.
9. Mees dan Paul., 2005, Privatization of Rail and Tram Services in Melbourne: What Went Wrong? *Transport Reviews*. 25 (4):433-449.
10. Murray., 2001, Strategic Analysis Of Public Transport Coverage, *Social Economic Planning Sciences*, 35,3: pp l175-188.
11. Morlok, E.K., 1991, Introduction to Engineering and Transport Planning, *Erlangga* : Jakarta.
12. Putra, A., 2006, Optimization of Fleet Amount and Public Transportation Tariff of Mikrolet Kota Makassar, Post Graduate Program of Hasanuddin University. Makassar
13. Pucher, J., Korattyswaropam, N., Mittal, N., and Ittyerah, N, 2005, Urban transport crisis in India, *Transport Policy*, Vol. 12, No. 3, pp. 185–198.
14. Schiller, P.L., Brunn, E.C., and Kenworthy, J. R., 2010, An Introduction to Sustainable Transportation: Policy, *Planning And Implementation, London*: Earthscan.
15. UNFPA (United Nations Fund for Population Division), 1999, State of World Population: six billion, a time for choice, United Nations Population Fund, New York.
16. World Bank., 1996, Sustainable Transport: Priorities for Policy Reform. *The International Bank for Reconstruction and Development*/*The World Bank*, Washington, D.
17. Wright, L., Fjellstrom., 2003, Module 3b: Bus Rapid Transit, (*Institute for Transportaion and Development Policy*), Germany: GTZ.
18. White, P.R., 1997, What Conclusions Can Be Drawn About Bus Deregulation in Britain? *Transport Reviews*. 17 (1):1.
19. Yao, X., 2007, Where Are Public Transit Needed, Examining Potential Demand For Public Transit For Commuting Trips." *Computers, Environment, and Urban Systems*. 31, 535-550.
20. Zietsman, J., and Rilett, L.R., 2001, Sustainable transportation: fad or fabulous", Paper presented to the 20th Annual South African Transport Conference, South Africa.